09674469
50C0

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH
RULE 17.1(a) OR (b)
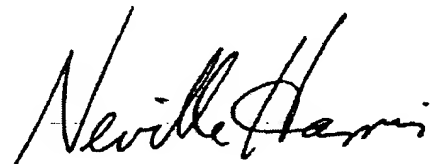
REC'D 2 4 JUL 2000

WIPO   PCT

CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 3 May 2000 with an application for Letters Patent number 504315 made by COMPUDIGM INTERNATIONAL LIMITED.

Dated 19 June 2000.

Neville Harris
Commissioner of Patents
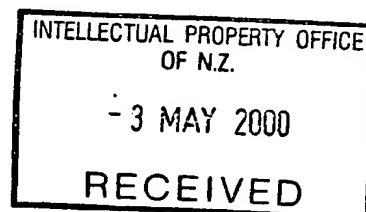
5

10

15   Patents Form No. 4

PATENTS ACT 1953

PROVISIONAL SPECIFICATION

20

TELECOMMUNICATIONS DATA VISUALISATION SYSTEM AND METHOD

We, **COMPUDIGM INTERNATIONAL LIMITED, a New Zealand company, of Level 16, Compudigm House, 49 Boulcott Street, Wellington, New Zealand,** do hereby declare

25   this invention to be described in the following statement:

TELECOMMUNICATIONS DATA VISUALISATION SYSTEM AND METHOD

FIELD OF INVENTION

5   The invention relates to a telecommunications data visualisation system and method.

BACKGROUND TO INVENTION

The flexibility of mobile phones, their reducing cost, and the wide coverage now

10 available has resulted in rapid growth in mobile phone use in many countries. A mobile phone user communicates with another mobile phone user by linking into a mobile phone network operated by a telecommunications provider. Mobile phone networks typically comprise one or more mobile phone sites which are small low powered radio transmitting and receiving stations. Each mobile site serves a limited geographic area

15 known as a cell. Each mobile site can only service a finite number of calls at any one time.

When a mobile phone is powered up, it generally searches for the strongest signal from a mobile site. The mobile phone is then registered as being located within the cell

20 covered by that mobile site. When a mobile phone user leaves one cell and enters another, the new site covering the new cell takes over the phone call, enabling the communication to be maintained. This procedure is often referred to as "handover".

The telecommunication service provider often needs to ensure that there are no gaps in

25 the signal from site to site to enable continuous coverage and service. On the other hand, the provider must also resolve interference between sites, particularly in urban areas. The provider must also ensure that there are sufficient sites and cells in each geographical area to handle instances of high demand, for example sports events. Instances of high demand can lead to connection failures such as "congestion" where a

30 customer cannot make a connection and "dropout" where a customer loses a connection during a call.

It is particularly important for a telecommunications service provider to monitor the capacity and usage of its network. It would be particularly desirable to display collected

35 data representing the use of its network in a form which is easily interpreted.

SUMMARY OF INVENTION

In broad terms the invention comprises a data visualisation system comprising a memory in which is maintained an interaction database of interaction data representing
5   interactions between customers and merchants; display means arranged to display a graphical representation of at least one merchant; retrieval means arranged to retrieve from the interaction database data representing interactions between customers and merchants; and report generating means arranged to superimpose a representation of the data retrieved from the interaction database on the representation of the merchant.

10
Preferably one or more of the merchants comprises a telecommunications service provider operating a telecommunications network.

Preferably the telecommunications network comprises a cellular network.

15
Preferably the interactions between customers and merchants comprise communications or attempted communications between customers over a telecommunications network operated by a merchant.

20   Preferably the graphical representation of each merchant comprises a representation of a network or part of a network operated by the merchant.

Preferably the representation of the data retrieved from the interaction database comprises a contoured representation.

25
In broad terms in another form the invention comprises a data visualisation method comprising the steps of maintaining in a memory an interaction database of interaction data representing interactions between customers and merchants; displaying a graphical representation of at least one merchant; retrieving from the interaction
30   database data representing interactions between customers and merchants; and superimposing a representation of the data retrieved from the interaction database on the representation of the merchant.

Preferably one or more of the merchants comprises a telecommunications service
35   provider operating a telecommunications network.

Preferably the telecommunications network comprises a cellular network.

Preferably the interactions between customers and merchants comprise communications or attempted communications between customers over a telecommunications network operated by a merchant.

5   Preferably the graphical representation of each merchant comprises a representation of a network or part of a network operated by the merchant.

Preferably the representation of the data retrieved from the interaction database comprises a contoured representation.

10

In another form in broad terms the invention comprises a data visualisation computer program comprising an interaction database of interaction data representing interactions between customers and merchants maintained in a memory; display means arranged to display a graphical representation of at least one merchant; retrieval

15   means arranged to retrieve from the interaction database data representing interactions between customers and merchants; and report generating means arranged to superimpose a representation of the data retrieved from the interaction database on the representation of the merchant.

20   Preferably one or more of the merchants comprises a telecommunications service provider operating a telecommunications network.

Preferably the telecommunications network comprises a cellular network.

25   Preferably the interactions between customers and merchants comprise communications or attempted communications between customers over a telecommunications network operated by a merchant.

Preferably the graphical representation of each merchant comprises a representation of

30   a network or part of a network operated by the merchant.

Preferably the representation of the data retrieved from the interaction database comprises a contoured representation.

BRIEF DESCRIPTION OF THE FIGURES

Preferred forms of the data visualisation system and method will now be described with reference to the accompanying figures, in which:

5   Figure 1 shows a block diagram of the system of the invention;

Figure 2 and Figure 3 show preferred form contoured representations;

10   Figures 4 to 8 show various forms of representations based on aggregated sites;

Figures 9 to 13 show various configuration for distributed sites; and

Figures 14 to 17 show various forms of contoured representations showing directional
15   information by sites relative to each other.

DETAILED DESCRIPTION OF PREFERRED FORMS

Referring to Figure 1, the preferred system comprises a data processor 2 interfaced to a
20   memory 4, the processor 2 and the memory 4 operating under the control of appropriate operating and application software. Stored in the memory 4 is a data repository, for example a data mart. It is envisaged that the data repository may alternatively comprise a single database, a collection of databases, or a data warehouse.

25   The preferred data mart includes interaction data representing interactions between customers and merchants as will be more particularly described below.

The processor 2 preferably comprises a multi-media server which could be interfaced to a suitable file server 6. The multi-media server 2 and file server 6 are preferably
30   interfaced to one or more clients 8 in a suitable client-server configuration. Each client 8 may include an input device, for example a keyboard and/or mouse, a display device for example a monitor, and suitable input/output devices such as disk drives, CD Rom drives and printers. Each client 8 could include a combination input and display device, for example a touch-sensitive screen.
35

The servers 2 and 6, the memory 4 and the clients 8 could be set up as standalone computers, or could be connected to further components in a network. Networks may be of any type, for example, Internet, Intranet, local area and wide area networks.

The data mart 4 is arranged to store interactions between customers and merchants. Preferably, the merchant comprises a telecommunications service provider operating a telecommunications network. The merchant preferably operates a cellular network

5 comprising one or more mobile phone sites 10. Each site 10 preferably comprises a small, low powered radio transmitting and receiving station or antenna which links a mobile phone user into the merchant's mobile phone network to connect or attempt to connect mobile phone users with each other. Each site 10 serves a limited geographic area or cell.

10

The merchant may also operate movable sites 12 which in one form could comprise omni directional antenna mounted on trucks. Groups of sites 10 and 12 are preferably controlled by one or more base station controllers 14. Each controller is arranged to

15 activate or deactivate individual sites as required and is also arranged to compile data representing the capacity and usage of individual sites. Each fixed site 10 and moveable site 12 are preferably reconfigurable and connections between the sites and each controller 14 are also reconfigurable so that the merchant can activate or deactivate specific sites to reduce gaps in coverage, to reduce interference between sites and to follow the demand around.

20

Data representing interactions between merchants and customers are preferably transferred from the base station controllers 14 to the data mart 4. Preferably the data undergoes data staging as indicated at 16 where the data is scrubbed and/or cleared and errors or anomalies are corrected.

25

The resulting data stored in the data mart 4 typically comprises one or more records. Each record may include, for example, a merchant identifier, a customer identifier, a cell and/or site identifier and other data such as the date and/or time at which the interaction between the customer and the merchant took place.

30

The data may also include values of one or more key performance indicators or KPIs. Typical KPI's could include network capacity, the percentage of capacity used, call volume, average length of current calls and/or instances and rates of connection failure.

35

The data is preferably migrated to the data mart 4 by way of regular updates or in real time. The data mart 4 could be maintained by a merchant or alternatively could be maintained by a third party. Updates to the data mart 4 could be carried out by the

merchant directly, or alternatively the merchant could provide batched data to a third party for updating the data mart 4. Alternatively, a third party could be entrusted with the task of collecting the interaction data from the base station controllers 14 and migrating the data to the data mart 4.

5

The system retrieves data representing interactions between customers and merchants as discussed above. After data retrieval, the system displays the data to a user on client 8, preferably as a graphic representation of the data. Where the merchant operates a telecommunications network, the graphical representation could include a

10 graphical spatial representation of the network represented by a collection of mobile sites, each site serving a geographic area or cell.

Figure 2 illustrates a typical graphical spatial representation of the merchant. Site or cells locations are indicated for example at 30 and 32. Figure 2 also shows at 40, one

15 preferred form representation of the data retrieved from the interaction database. The representation 40 preferably comprises a series of contours representing the values of one or more key performance indicators (KPI's). The preferred representation 40 is arranged as contour lines around the site or cell locations in the spatial representation of the merchant.

20

In some circumstances, it is desirable to combine or aggregate customer interactions among two or more cells. Data relating to separate cells is often combined prior to or during data capture, resulting in the loss of some data. In these cases, it may be desirable to aggregate two or more cells.

25

One preferred form aggregation method includes combining interactions involving cells 30, 32, 34, 36 and 38. The representation 40 is generated from a single data point located at cell 38.

30 An alternative representation 50 is illustrated in Figure 3. The KPI values of cells 30, 32, 34, 36 and 38 are aggregated and the average KPI value of these sites is then calculated. Contoured representation 50 is generated from a set of 5 data points, each data point centred on a respective site. Each data point has the average or mean value of the set of sites 30, 32, 34, 36 and 38.

35

Further preferred representations for displaying aggregated KPI site values are discussed with reference to Figures 4 to 8. In each case, the system is arranged to

176139 v1 WGN

show part of a merchant's network, particularly the part of the network in use by customers located at a particular venue, for example a sports event.

5 Figure 4 illustrates a contoured representation 60 generated by aggregating all site values over an area indicated by outline 62. The representation 60 could be generated from a single data point located at 64.

As shown at Figure 5, in one preferred form of contoured representation 70, the representation could be generated from a single data point 72 representing the
10 aggregate of individual sites located within the area represented by the representation 70. The representation 70 may identify the individual sites which are being aggregated by displaying lines 74 radiating from data point 72 to the position of each individual site.

15 Referring to Figure 6, the representation 80 could include outline 82 of the area over which the aggregation has taken place. The preferred representation 80 is generated as a function of a single central data point 84. The representation may also include a schematic view of the venue, for example a sports stadium or sports field as indicated at 86.

20
Referred to Figure 7, a preferred representation 90 could include an outline of a venue 92, a central data point 94, lines 96 radiating from the central point 94 to each site, and a schematic representation of the venue indicated at 98.

25 As shown in Figure 8, the system may display representation 100 showing a simplified representation of the data. By clicking "zoom box" 102, the user could be presented with a more detailed view of the data, for example the views shown in Figures 4 to 7.

Figures 9 to 13 illustrate preferred forms of representations showing individual cell sites
30 and connections between cell sites. Representations could include for example the skeleton shown in Figure 9, a no new point skeleton shown in Figure 10, a convex hull shown in Figure 11, a combination convex hull and skeleton shown in Figure 12 and bones shown in Figure 13. It will be appreciated that different arrangements of sites are more suitable for certain types of site coverage. For example, the convex hull shown
35 in Figure 11 is particularly suitable for representing site coverage of a localised venue for example a stadium, whereas the skeleton of Figure 9 could be more suited to showing cellphone coverage over a more diverse geographic area.

Further forms of preferred representations are described with reference to Figures 14 to 17. In some circumstances, two or more sites will be positioned in the same geographical area. Alternatively, it may be desirable to display the aggregation of several sites from a single data point but yet maintain the ability to display differences between site values.

Figure 14 illustrates one preferred form representation 110. The representation is generated from a single data point 112 which represents the aggregation of KPI values at three distinct cellphone sites. The positions of the sites are indicated by lines 114, 116 and 118 extending radially from data point 112 to each site.

Figure 15 shows a further preferred form representation 120 which is centred on single data point 112._ The circular representation of Figure 14 is essentially stretched_in Figure 15 along respective lines 114, 116 and 118, depending on the length of each line.

A further preferred form representation 130 is shown in Figure 16, in which the contour lines representing the cellphone sites are each connected at central data point 112.

Alternatively as shown in Figure 17, representation 140 could be divided into sectors. The representation 140 is centred around central data point 112 with lines 114, 116 and 118 radiating outward from the data point. Sector lines 142, 144 and 146 are positioned between pairs of adjacent lines, and representations generated between these sector lines. Each sector preferably has a radius calculated as a function of the length of individual lines 114, 116 and 118.

It will be appreciated that the contoured representations of the invention could be applied to various types of electronic communications. For example, the system could display representations of communications over an analog or digital cellular network, a landline such as a PSTN, a paging network, or a satellite network. As is becoming increasingly common, the system could also be arranged to display data relating to digital communications for example text messaging and Internet communications.

The foregoing describes the invention including preferred forms thereof. The invention provides a user-friendly system and method suitable for analysing the capacity and usage of a network. The system enables a merchant, for example a telecommunication service provider, to monitor periods and areas of high demand to enable the provider to reconfigure a network to cope with such demand. Alterations and modifications as will

be obvious to those skilled in the art are intended to incorporated within the scope hereof.

WEST-WALKER BENNETT

per

ATTORNEYS FOR THE APPLICANT

Movable

12

Reconfigurable

Files transferred every minute

10

14

BSC

BSC

Mobile Network

16

Data Staging

Data Mart

4

SeePower

FIGURE 1

File Server

6

Multi Media Server

2

Client

Client

Client

Client

8

50

30

32

36

38

34

FIGURE 3

30

40

32

36

38

34

FIGURE 2

Outline

FIGURE 4

60

62
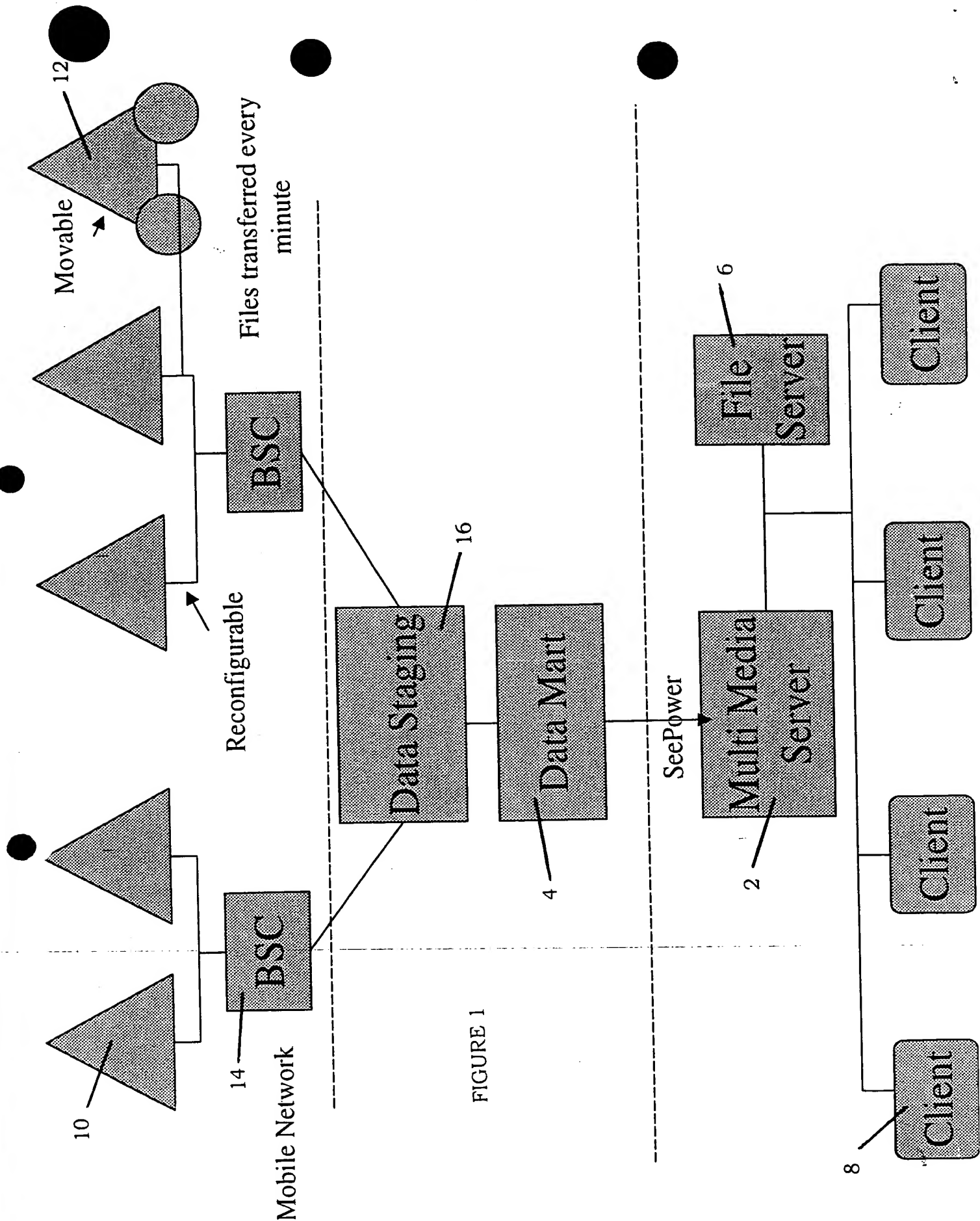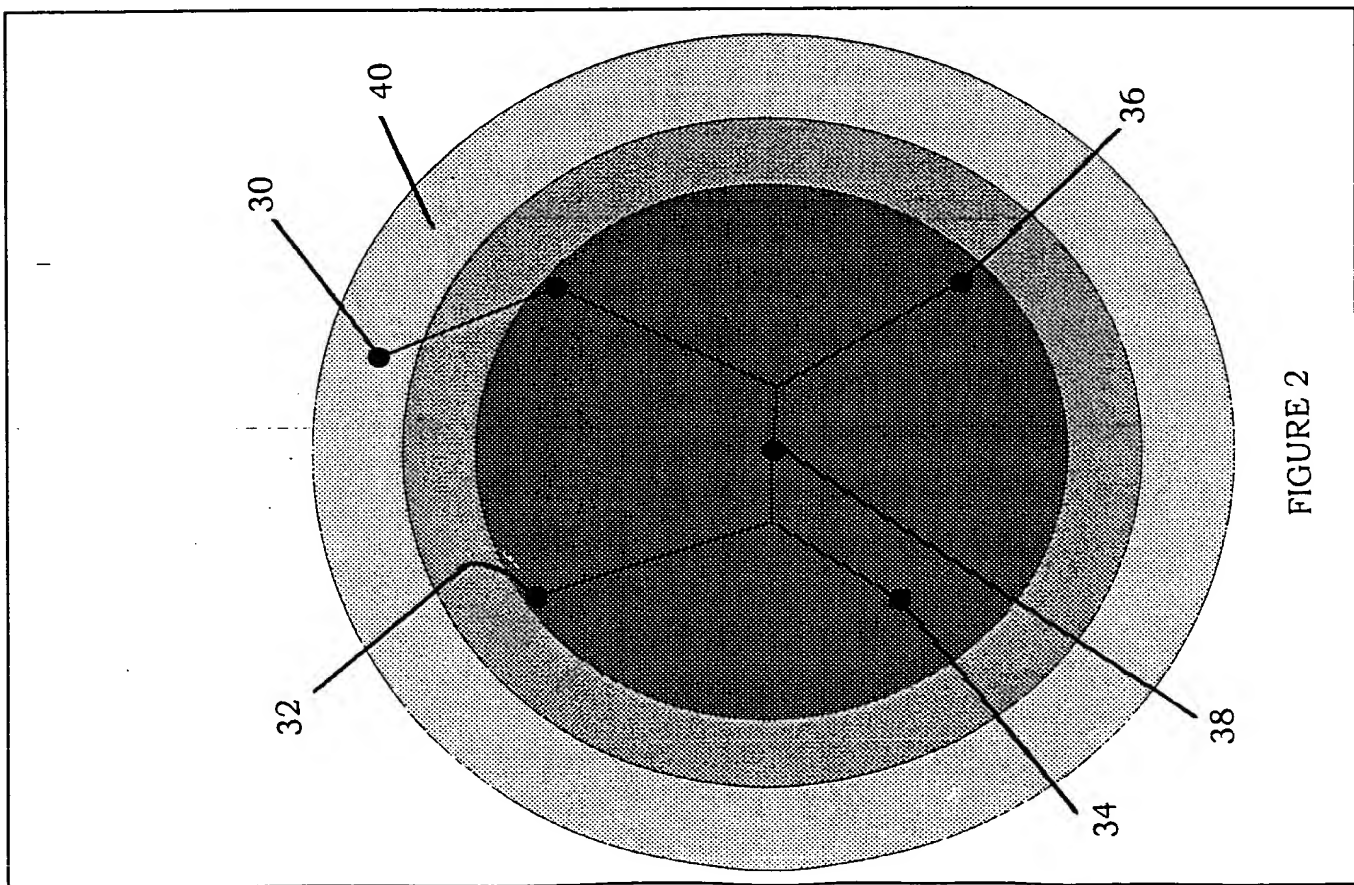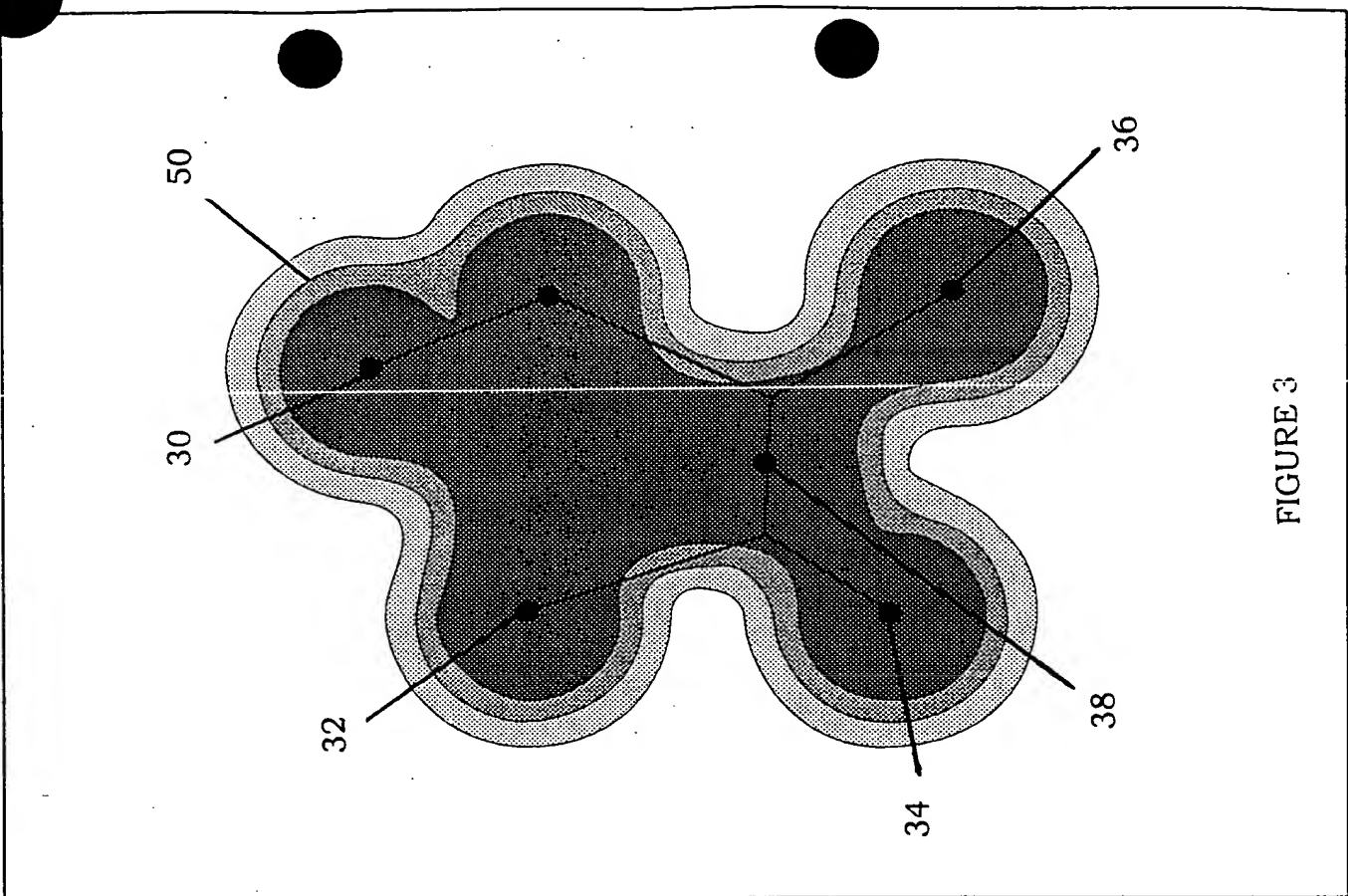
64

Skeleton

FIGURE 5

70

74

72
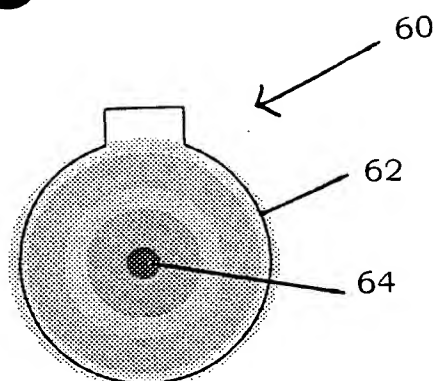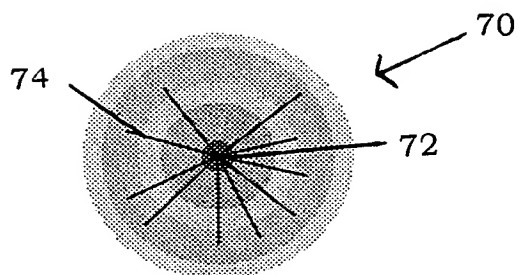
Schematic

FIGURE 6

80

82

86

84
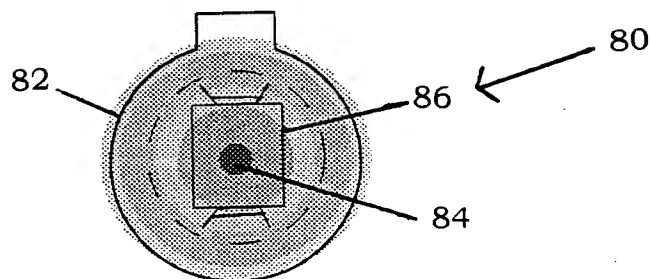
Skeleton and Schematic

FIGURE 7

90

92

94

96

98

Zoom Box

FIGURE 8

102

100

FIGURE 10

no new point skeleton
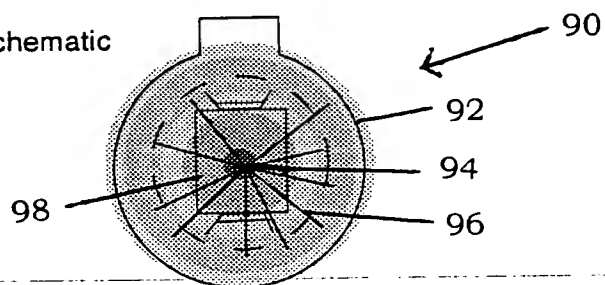
FIGURE 13
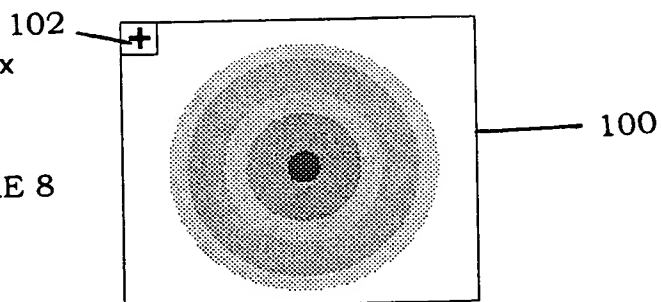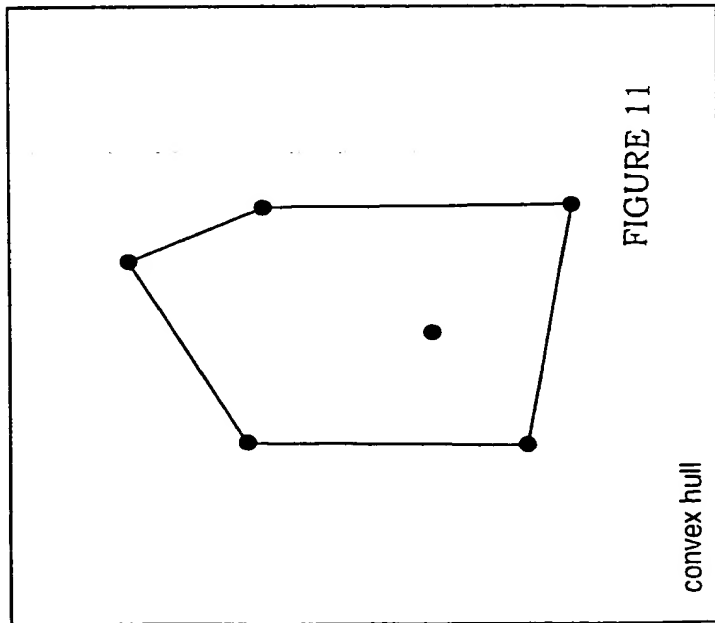
bones

FIGURE 9
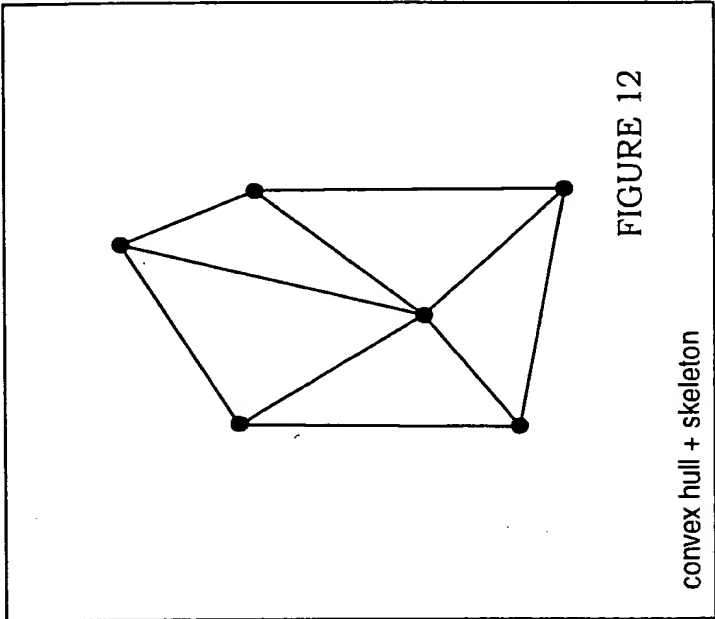
skeleton

FIGURE 12

convex hull + skeleton

FIGURE 11

convex hull

114

142

116

144

140

118

112

146

FIGURE 17

disjoined sections

130

112

FIGURE 16

poles

116

120

114

118

112

FIGURE 15

merged

116

110

114

118

112

FIGURE 14

combined